NON-PUBLIC?: N
ACCESSION #: 9111070005
LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas, Unit 1 PAGE: 1 OF 05

DOCKET NUMBER: 05000498

TITLE: Reactor Trip Due to Motor Generator Malfunction
EVENT DATE: 04/12/91 LER #: 91-012-01 REPORT DATE: 10/31/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 040

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Charles Ayala - Supervising TELEPHONE: (512) 972-8628
Licensing Engineer

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On April 12, 1991, at 0418, the Unit 1 reactor tripped from 40% power. A turbine trip, feedwater isolation and auxiliary feedwater actuation occurred as a result of the reactor trip. Systems operated as designed in response to the reactor trip. It was determined that Rod Drive Motor Generator (RDMG) Set #11 tripped due to a transient induced by RDMG #12 which was found running with its motor and generator breakers closed with no output voltage to the Reactor Trip Switchgear. It is believed that intermittent pick-up and drop-out of the 2R relay, which actuates contacts to supply power to the RDMG Set #12's generator voltage regulator, caused instability in the voltage regulator operation. The 2R relay malfunction was due to a defective output switch. The instability of the voltage regulation resulted in transients that caused a reverse current to the RDMG Set #11 and a subsequent trip of the generator output breaker. It is also believed that the 2R relay contacts supplying power to the voltage regulator eventually remained open long enough to allow a

loss of the generator field in the RDMG Set #12. A loss of the generator field results in zero output voltage from the generator. The loss of both of the power sources to the Reactor Trip Switchgear resulted in a reactor trip. The 2R relay's timer and control relay were replaced and a procedural change has been made to enhance the detection of relay timer malfunctions. An additional procedural change has been made to require the marking of leads that do not have unique identification markings.

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END OF ABSTRACT

DESCRIPTION OF EVENT:

On April 12, 1991, at 0418 hours, the Unit 1 reactor tripped from 40% power. A turbine trip, feedwater isolation and auxiliary feedwater actuations occurred as a result of the reactor trip and all systems operated as designed. The "ROD DRIVE MG SET TROUBLE" annunciator came in several seconds prior to the reactor trip indicating a loss of one or both of the Rod Drive Motor Generator (RDMG) set power sources to the Reactor Trip Switchgear/Control Rod Drive Mechanisms. Upon further inspection by Plant Operations personnel, the RDMG Set #11 generator output breaker was found open due to phase-A directional overcurrent relay actuation and the RDMG Set #12 was running with its motor and generator breakers closed and no output voltage to the Reactor Trip Switchgear. Following the reactor trip, Plant Operations personnel stabilized Unit 1 at 0% reactor power with RCS pressure at 2235 psig and RCS temperature at 567 degrees F (Mode 3, Hot Standby).

Further investigation by plant personnel revealed that, 1) the RDMG Set #12 generator voltage failed to hold and regulate after the generator's Field Flash pushbutton was pressed and, 2) the 2R (Regulator Power Relay) was chattering loudly when the Field Flash pushbutton was pressed. A work document was initiated to troubleshoot and investigate the problems noted in the RDMG Set #12. Also, a work document was initiated to troubleshoot the RDMG Set #11 to determine the cause of the phase-A directional overcurrent condition that tripped the MG set.

A calibration of the RDMG Set #11's IRV relay (directional overcurrent relay) was performed per procedure (Calibration of Westinghouse IRV Relay). This calibration found Minimum Pickup Test parameters for the IRV relay slightly above tolerance, but this out of tolerance was not the cause of the RDMG Set #11 trip.

In order to isolate the cause of the chattering observed in the 2R relay, the troubleshooting included continuity checks of the circuitry required for actuating the 2R relay contacts. The troubleshooting revealed that an electronic switch internal to the 2R relay timer was malfunctioning. Inconsistent voltage measurements across the electronic switch indicated that the electronic switch was erratic, causing the control voltage to the 2R relay to vary and the 2R relay to pick-up and drop-out erratically as well. The 2R relay controls contacts, that supply power to the RDMG Set #12's generator voltage regulator and field. The 2R relay is composed of a Westinghouse type AR control relay and a Westinghouse type ART-OF solid state timer. The type ART-OF timer is mounted on the type AR control relay to provide timed operation of the AR relay. To verify that the switch was causing the malfunction, the timer was removed from the circuitry and a temporary manual

DESCRIPTION OF EVENT: (Cont'd)

switch was jumpered across the electronic switch's terminal points on the 2R relay. With these jumpers in place the 2R relay operated satisfactorily and no relay chattering was observed. The 2R relay's timer and control relay were replaced with a new Westinghouse type ART-OF timer and type AR control relay. Post maintenance testing performed after the installation of the new timer and relay verified the RDMG sets to be operating satisfactorily in the single and parallel operation modes.

A review of the maintenance history since preventive maintenance was performed for the Unit 1 RDMG sets indicated previous problems with the 2R relay. On February 16, 1991, while performing the calibration of the timing relays during the refueling outage, the 1R timer (functionally identical timer to the 2R timer, but utilized in the RDMG Set #11) and the 2R timer setpoints were found to be out of tolerance. Electrical Maintenance personnel were unable to adjust the relays' setpoint within the acceptance criteria. The 1R/2R relay ART-OF timers were replaced on February 20, 1991 per the corrective actions specified. The type AR control relays were not replaced on the 1R or 2R relay. During the replacement of the relay timers, the 1R and 2R relays were calibrated to acceptable setpoint values.

On March 12, 1991, it was reported that the RDMG Set #12 was not maintaining a voltage after the Field Flash pushbutton was released and chattering was noted in the 2R relay. Additionally, it was reported that

resistors R3 and R4 showed signs of overheating. Troubleshooting actions revealed errors in the wiring of the 2R relay. The wiring errors were corrected and the 2R relay's type AR control relay was replaced. There were no problems noted with the operation of relay's type ART-OF timer at this time, therefore, the timer installed per the actions noted in the preceding paragraph remained in service. To determine whether the miswiring had adversely affected the operation of the 2R relay's timer the timer vendor (Westinghouse) was contacted and furnished with a sketch of how the timer was miswired. Westinghouse's response did not rule out the possibility of damage or degradation due to miswiring of the timer. The timer also has a label stating "Caution, Incorrect wiring can cause failure." Post maintenance testing involving the operation of the RDMG Set #12 was completed satisfactorily to verify the 2R relay's operability.

It was noted that the procedure did not provide an adequate barrier for detecting/preventing wiring errors of the type noted in this investigation. Procedure OPGP03-ZM-0021, "Control of Configuration Changes," requires the lead to be lifted to have an identification marking. If permanent identification markings (i.e. wire markers, etc.) are not present, a maintenance identification tag shall be used. OPGP03-ZM-0021, should have also required the use of maintenance identification tags whenever leads to be lifted are similarly marked and not uniquely identified.

CAUSE OF EVENT

The new 2R timer installed on February 20, 1991 had a defective output switch. It is believed that intermittent pick-up and drop-out of the 2R relay, which actuates contacts to supply power to the RDMG Set #12's generator voltage regulator, caused instability of the voltage regulator operation. The instability of the voltage regulator resulted in transients that caused a reverse current to the RDMG Set #11 and a subsequent trip of the generator output breaker. It is also believed that the 2R relay contacts supplying the power to the voltage regulator, eventually remained open long enough to allow a loss of the generator field in the RDMG Set #12. A loss of the generator field results in zero output voltage from the generator. The loss of both of the power sources to the Reactor Trip Switchgear resulted in a reactor trip on negative reactivity rate.

ANALYSIS OF EVENT:

Unstable voltage regulation caused by the failure of the electronic switch internal to the 2R relay's timer resulted in transients that caused the loss of both power sources to the Reactor Trip Switchgear. The result of this failure was a reactor trip. Unplanned actuation of a Reactor Protection System is reportable pursuant to 10CFR50.73(a)(2)(iv). This event did not result in any increased risk to the safe operation of the plant. All safe
y systems functioned as required.

CORRECTIVE ACTIONS:

1. Troubleshooting (MWR 117861) revealed a failure of the 2R relay's solid state timer. The 2R relay's timer and control relay were replaced. Post maintenance testing verified that the RDMG sets were operating satisfactorily.

2. Procedural changes have been made to OPMP05-ZE-0047 (Calibration of Timing Relays) to include additional instructions for testing Westinghouse type ART-OF timers. This information will be beneficial in detecting relay timer malfunctions.

3. An investigation into the effects of the miswiring of the relay on the timer's electronic switch was completed by contacting the timer vendor (Westinghouse). The vendor's response indicated that failure of the timer's electronic switch could have been caused by miswiring, though this could not be established with absolute certainty with the evidence available.

CORRECTIVE ACTIONS: (Cont'd)

4. Procedural changes have been made to OPGP03-ZM-0021 (Control of Configuration Changes) to require the marking of leads that do not have unique identification markings with maintenance identification tags or temporary wire markers. This will enhance the procedure's function as a barrier to prevent wiring errors when leads are marked similarly and are indistinguishable from each other.

5. Procedural changes will be made to OPGP03-ZM-0021 (Control of Configuration Changes) to provide for use of a sketch to illustrate the physical location of termination points. This procedure will be revised by March 26, 1992.

ADDITIONAL INFORMATION:

The 2R relay is composed of a Westinghouse, type AR control relay and type ART-OF relay timer.

There have been no similar events at either unit at STPEGS.

A search of NPRDS Database showed five previous cases of RDMG sets tripping due to either directional overcurrent or instantaneous overcurrent. In four of the cases, problems with a voltage regulator were suspected as the cause of the transient that caused the trip.

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The Light
Company South Texas Project Electric Generating Station
Houston Lighting & Power P.O. Box 289 Wadsworth, Texas 77483

October 31, 1991
ST-HL-AE-3914
File No.: G26
10CFR50.73

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project Electric Generating Station
Unit 1
Docket No. STN 50-498
Supplement to Licensee Event Report 91-012
Regarding a Reactor Trip Due to Motor Generator Malfunction

Pursuant to 10CFR50.73, Houston Lighting & Power Company (HL&P) submits the attached Licensee Event Report (LER 91-012) regarding a reactor trip resulting from the loss of power to Reactor Trip Switchgear/Control Rod Drive Mechanisms.

This supplement provides the results of HL&P's investigation into the effects of the miswiring of the relay on the timer's electronic switch. As a result of the investigation. Two additional corrective actions, have been added. Changes are indicated by change bars.

If you should have any questions on this matter, please contact Mr. C. A. Ayala at (512) 972-8628 or myself at (512) 972-7205.

William J. Jump
Manager,
Nuclear Licensing

JMP/amp

Attachment: Supplement to LER 91-012 (South Texas, Unit 1)

LER\91254001.U1

A Subsidiary of Houston Industries Incorporated

cc:

Regional Administrator, Region IV Rufus S. Scott
Nuclear Regulatory Commission Associate General Counsel
611 Ryan Plaza Drive, Suite 400 Houston Lighting & Power Company
Arlington, TX 76011 P.O. Box 61867
Houston, TX 77208
George Dick, Project Manager
U.S. Nuclear Regulatory Commission INPO
Washington, DC 20555 Records Center
1100 Circle 75 Parkway
J. I. Tapia Atlanta, GA 30339-3064
Senior Resident Inspector
c/o U. S. Nuclear Regulatory Dr. Joseph M. Hendrie
Commission 50 Bellport Lane
P.O. Box 910 Bellport, NY 11713
Bay City, TX 77414
D. K. Lacker
J. R. Newman, Esquire Bureau of Radiation Control
Newman & Holtzinger, P.C. Texas Department of Health
1615 L Street, N.W. 1100 West 49th Street
Washington, DC 20036 Austin, TX 78756-3189

D. E. Ward/T. M. Puckett

Central Power and Light Company
P.O. Box 2121
Corpus Christi, TX 78403

J. C. Lanier/M. B. Lee
City of Austin
Electric Utility Department
P.O. Box 1088
Austin, TX 78767

K. J. Fiedler/M. T. Hardt
City Public Service Board
P.O. Box 1771
San Antonio, TX 78296

Revised 10/11/91

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